Interventions to optimise prescribing in care homes: systematic review

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Abstract

Background: prescribing for older people is a complex process and can elevate the risk of inappropriate prescribing, with potentially severe consequences. With a growing ageing population, strategies to improve prescribing in care homes are essential. Our aim was to review systematically the effects of interventions to optimise prescribing in care homes.

Method: databases searched were MEDLINE, EMBASE, International Pharmaceutical Abstracts and the Cochrane Library from 1990. Search terms included were ‘nursing home’, ‘residential home’, ‘inappropriate prescribing’, ‘education’ and ‘intervention’. Two independent reviewers undertook screening and methodological quality assessment, using the Downs and Black rating scale.

Results: the search strategy retrieved 16 studies that met the inclusion criteria. Four intervention strategies were identified: staff education, multi-disciplinary team (MDT) meetings, pharmacist medication reviews and computerised clinical decision support systems (CDSSs). Complex educational programmes that focused on improving patients’ behaviour and drug prescribing were the most studied area, with six of eight studies highlighting an improvement in prescribing. Mixed results were found for pharmacist interventions. CDSSs were evaluated in two studies, with one showing a significant improvement in appropriate drug orders. Two of three studies examining MDT meetings found an overall improvement in appropriate prescribing. A meta-analysis could not be performed due to heterogeneity in the outcome measures.

Conclusion: results are mixed and there is no one interventional strategy that has proved to be effective. Nevertheless, education including academic detailing seems to show most promise. A multi-faceted approach and clearer policy guidelines are likely to be required to improve prescribing for these vulnerable patients.

Keywords: systematic review, nursing home, inappropriate prescribing, intervention trial, pharmacist, multi-disciplinary, elderly

Introduction

Prescribing in older people is a complex process. Older people often have multiple co-morbidities, age-related pharmacokinetic and pharmacodynamic changes and polypharmacy [1]. Drug safety profiles may have improved in modern medicines provided drugs are prescribed and used appropriately. However, randomised controlled trials of drug treatment for common conditions in the elderly often focus on a single-disease process; they often do not take into account co-morbidities and other factors that may affect the response to treatment; for example, drug–drug interactions and the effect of the drug on other disease processes [2].

Older people are prescribed more medication than younger people. In England, for instance, while younger people received an average of 9.5 items per year, people aged 60 and over received an average of 42.4 items in 2007 [3]. This almost doubled over a 10 year period; the corresponding figure in 1997 was 22.3 prescription items [3]. With a growing older population, use of prescription medication is projected to rise further as chronic conditions, such as diabetes and hypertension will require more intensive therapy. These high levels of...
Care homes’ prescribing interventions

Methods

Data sources and search strategy
The search strategy aimed to retrieve papers on interventions to improve prescribing in care homes (residential, nursing and mixed homes; defined in Supplementary data, available in Age and Ageing online). Databases used were OVIDSP (MEDLINE and EMBASE), International Pharmaceutical Abstracts and the Cochrane Library. We combined three groups of keywords: those relating to the care home setting, those relating to IP and those relating to interventions (Figure 1). All retrieved articles were initially assessed by title and abstract to find potentially relevant papers. The reference lists for articles that met the inclusion criteria were then reviewed to identify any further papers.

Study selection
Selected papers were assessed against the following inclusion criteria: (i) randomised or non-randomised controlled studies; (ii) residents’ mean age ≥65; (iii) care home-based setting; (iv) evaluated the effect of an intervention on prescribing, aimed at improving appropriate prescribing or reducing IP; (v) written in English; (vi) published between 1990 and April 2010. Studies published only as abstracts were excluded. In this review, IP in older people was defined as (i) use of medicines that pose more risk than benefit (particularly when safer alternatives exist); (ii) prescribing of inappropriate dose or duration of drugs; (iii) presence of clinically significant drug-drug and drug-disease interactions; (iv) under-use of potentially beneficial medications (v) or duplication of agents.

Data extraction and quality assessment
Two reviewers performed the search and then screened the titles and abstracts independently to identify studies that met the inclusion criteria. Any discrepancies were resolved by discussion or a third independent reviewer. Relevant full text articles were then reviewed to extract specific details. Outcome measures were examined to assess whether a meta-analysis could be performed.

A quality assessment was conducted for each study using a modification of the Downs and Black tool. The published tool comprises 27 items with a maximum score of 32; the last item evaluating the power of the study is scored out of 5. However, in line with previous studies, this was omitted due to its potential ambiguity; hence, the maximum score in our review was 27. Scoring was completed by two independent reviewers and discrepancies were resolved through discussion or by a third independent reviewer. Higher scores reflected better study quality.

Results
A total of 512 articles were identified, of which 16 met the inclusion criteria. Studies were conducted in nursing homes, residential homes, long-term care facilities and mixed homes. Overlaps between some of the interventions exist. However, for the purpose of this review, interventions were grouped into one of the following four groups: staff education (prescribers and/or care home staff; n = 8), multi-disciplinary team (MDT) meetings (usually chaired by the prescribing physician; n = 3), pharmacist medication reviews (n = 3) and computerised clinical decision support systems (CDSSs; n = 2). Mean quality scores are presented in Supplementary data, available in Age and Ageing online; studies were generally of high quality with mean scores of 20 and above. Two had much lower scores, one due to potential selection bias [17] and one due to potential confounding in a partially controlled before-and-after study [18]. Meta-analysis could not be performed due to heterogeneity in the outcomes measured.

Staff education
Eight studies (Table 1) reviewed the impact of educational interventions; six showed statistically significant improvements in prescribing quality [18–23]. Academic detailing was used in six of the eight studies, sometimes combined with additional strategies. This is an educational outreach
programme by an expert, involving face-to-face education with prescribers to discuss relevant clinical practice. Fossey et al. (UK), Meador et al. (USA) and Ray et al. (USA) evaluated the effect of enhanced psychosocial care training on neuroleptic use, focusing on behaviour management [19–21]. They reported decreased numbers of residents on neuroleptics, reduced antipsychotic doses and reduced days on antipsychotics, respectively. Eide et al. (Norway), in their before-and-after study with additional post-intervention concurrent controls, described the effects of a pharmacist-led education programme on the prescribing of hypnotics [18]. Of six outcome measures assessed, only one showed a significant improvement. Avorn et al. (USA) focused on geriatric psychopharmacology, where a comprehensive educational outreach programme led by a pharmacist focused on reducing the overall use of psychotics by improving the selectivity of their use [22]. The intervention resulted in decreased mean psychoactive drug use.
<table>
<thead>
<tr>
<th>Intervention</th>
<th>Author et al. (country, year)</th>
<th>Design and setting</th>
<th>Age</th>
<th>Inclusion and exclusion criteria</th>
<th>Description of intervention</th>
<th>Outcomes</th>
<th>Follow-up</th>
<th>Statistically significant findings</th>
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<tbody>
<tr>
<td>Staff education</td>
<td>Fossey et al. (UK, 2006) [19]</td>
<td>Cluster RCT, 349 NHR; 12 NHs (four each in London, Newcastle and Oxford)</td>
<td>Median = 82</td>
<td>Inclusion: NHs with a minimum 25% of residents with dementia taking neuroleptics</td>
<td>Training and support to NH staff on alternatives to neuroleptic use and behavioural management techniques led by psychologist/nurse/OT. Old age psychiatrist telephoned to provide/wrote prescribing recommendations.</td>
<td>Proportion of NHR prescribed neuroleptics</td>
<td>12 months</td>
<td>Average reduction in proportion of NHR taking neuroleptics (19.1%, 95% CI 0.5–37.7%, ( P = 0.045 ))</td>
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<tr>
<td>Eide et al. (Norway, 2010) [18]</td>
<td>Before-and-after study with additional post-intervention concurrent control, 266 NHR; 5 NHs</td>
<td>Mean = 86.5</td>
<td>Baseline data from 1995 study, post-intervention in 2000 with additional concurrent data from control homes</td>
<td>Results from baseline data on poor use of hypnotics sent to physicians, nurses and directors of the institutions. AD: pharmacists held meetings with physicians and nurses to discuss use of hypnotics; information described as six simple ‘rules’ (e.g. avoid administration early in the evening).</td>
<td>Change in use of hypnotics</td>
<td>5 years</td>
<td>Higher proportion of patients in 2000 versus 1995 who used high-dose hypnotics. Proportion of patients who received hypnotics before 9 p.m. reduced; 44.3% versus 13.3% in 2000 (( P &lt; 0.01 ))</td>
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<td>Avorn et al. (USA, 1992) [22]</td>
<td>Cluster RCT, 823 NHR; 12 NHs</td>
<td>N/A</td>
<td>Exclusion: NHs with atypically high/low levels of psychotropics</td>
<td>Sessions on geriatric pharmacopsychology, e.g. alternatives to sedation in behaviour problems/insomnia. Face-to-face education to nurses. Leaflets to all physicians of NHR. AD: physicians invited for separate session with pharmacist if their prescribing was above threshold during baseline evaluation.</td>
<td>Total drug use of hypnotics/benzodiazepines/antipsychotics, psychoactive drug use scores</td>
<td>5 months</td>
<td>27% (intervention) versus 8% (control) in mean psychoactive drug use. 32% (intervention) versus 14% (control) had antipsychotics discontinued. Greater reduction in no. of days of antipsychotics use per patient per month in intervention versus control. Greater no. of non-recommended hypnotics discontinued and substituted with acceptable drugs/stopped completely (45% versus 21%).</td>
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<td>Rovner et al. (USA, 1996) [25]</td>
<td>RCT, 89 NHRs; 250 bed intermediate care NHs</td>
<td>Mean = 81.6</td>
<td>Inclusion: residents with both behavioural disorders and dementia</td>
<td>Implementation of new prescribing guidelines according to protocol for psychotropic drug management led by study psychiatrist. Weekly 1 h educational rounds led by psychiatrist on patients’ medical status/behaviours.</td>
<td>Composite behavioural disorder—measured as present/absent, antipsychotics use and restraint use</td>
<td>6 months</td>
<td>None</td>
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<th>Intervention</th>
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<tr>
<td>Stein et al. (USA, 2001) [23]</td>
<td>Cluster RCT, 147 NHR; 10 pairs of NHs</td>
<td>&gt;65</td>
<td>Inclusion: NHs with high proportion of residents on NSAIDs (at least 8% on NSAIDs each month), NH with &gt;1.2 g ibuprofen dose equivalents per day for at least 4 of the past 7 days</td>
<td>30 min structured training session for staff (60–65% attendance) Telephone conversations (n = 8) by primary care physicians visited (n = 27) by study physician (educational message included risks and benefits of NSAIDs, algorithm for stopping NSAIDs treatment, or substituting with paracetamol or topical analgesia and non-pharmacological methods for muscular pain management)</td>
<td>NSAIDs and paracetamol use</td>
<td>3 months</td>
<td>Decrease in mean no. of days of NSAIDs use from 7.0–1.9 days (intervention) versus 7.0–6.2 days (control), P = 0.0001 Increase in paracetamol use by 3.1 days (intervention) versus 0.31 days (control), P = 0.0001</td>
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<td>Meador et al. (USA, 1997) [20]</td>
<td>Cluster RCT, 1311 NHR; 12 NHs</td>
<td>Mean = 83.5</td>
<td>Inclusion: NHs with antipsychotic use prevalence 20%, mean dose ≥100 mg thioridazine equivalents, not specialised in psychiatric patients, no programme to withdraw antipsychotic drugs, NH for at least 6 months after date of study</td>
<td>AD: a 45–60 min visit by geropsychiatrist to all physicians to discuss risk and benefits of antipsychotics, physicians received referral card with summary of key points and flow chart for antipsychotic withdrawal Five to six 1 h programmes for NH staff over a 1 week period, staffs received professionally designed manuals that described behaviour management programme Follow-up session after 4 weeks Evening meeting for families when requested</td>
<td>Changes in days of antipsychotic use per 100 days of stay, withdrawal from antipsychotics, reduction in antipsychotic dose by 50% or more</td>
<td>6 months</td>
<td>Decrease in antipsychotic use from 25.3 per 100 days to 19.7 per 100 days, 23% NHRs had their antipsychotic dose reduced by 50% relative to control (P = 0.014)</td>
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Ray et al. (USA, 1993) [21]

Controlled before-and-after, 378 NHR; 4 rural NHs

Mean $=81.9$ Inclusion: 2 homes with point prevalence of antipsychotic use $>25\%$ and stable for 6 months, 2 comparable homes as controls

AD: old age psychiatrist educated physicians on risks/benefits of antipsychotics, reference card with recommendations and flow chart for drug withdrawal given

Six 1 h sessions for NH staff in 3 weeks (held multiple times to enable all staff to attend)

Behaviour management programme explained via role play and case examples

Manual for weekly follow-up sessions

A 4 h consultation by NH management specialist to home’s administrator addressing quality care

Evening meetings with families to address concerns and explain programme

8 weeks’ post intervention, meeting held with home medical director, director of nursing, psychiatrist and nurse educator to discuss difficult patients

Changes in administration of psychotropic drugs, physical restraint use, frequency of behaviour problems

13 months Days on antipsychotics decreased by 72% (intervention) versus 13% (control) ($P < 0.001$)

Intervention: 44 of 63 (70%) patients on antipsychotics attempted withdrawal and successful in 30 (48%); control: withdrawal attempted in 13 of 59 (22%) patients and successful in 7 (12%), $P < 0.001$

Crotty et al. (Australia, 2004) [24]

Cluster RCT, 715 NHR; 20 residential facilities-10 hostels (low care) and 10 NHs (high care)

Mean $=84.1$ Inclusion: each pair matched from different regions in Adelaide to avoid having homes where the same GP was looking after

AD: intervention physicians received two 30 min visits by pharmacists, pharmacists visited each facility to speak to staff including physicians re: reducing psychotropic medication, nurses received four 2 h sessions on management of dementia behavioural symptoms, medication management, and fall prevention

Discussed benefits of aspirin for those with stroke risk, use of warfarin for AF and treatment for HTN

Change in percentage of falls, change in psychotropics/warfarin/antihypertensives/aspirin prescriptions

7 months None

*Only significant improvement in prescribing described.
scores, a scoring tool developed by the authors. Stein et al. (USA) assessed the effect of a 30 min structured training session on non-steroidal anti-inflammatory drugs (NSAIDs) prescribing and found decreased NSAIDs use [23]. Neither the studies of Crotty et al. (Australia) [24], which focused on falls and stroke prevention using pharmacist-led education, or Rovner et al. (USA) [25] which evaluated the effect of educational round by a psychiatrist, resulted in statistically significant changes in prescribing.

Pharmacist medication reviews

Three studies (Table 2) investigated the impact of pharmacist-led interventions on prescribing [26–28]. Various strategies were used: a single medication review plus consultation with carer and patient, and a clinical pharmacy programme utilising a number of different interventions. Only one of the studies reported statistically significant changes: Zermansky et al. (UK) assessed effects of a clinical medication review and reported significant changes in the number and type of medication (medications discontinued and commenced), but the total number of medications used remained the same.

Furniss et al. (UK) examined the effects of medication review by a pharmacist and assessed appropriateness of prescribing of neuroleptics based on the USA’s Omnibus Reconciliation Act (OBRA) 1987 guidelines [27]. There was a decline in the number of drugs prescribed with corresponding savings in drug costs, although this was not statistically different. Roberts et al. (Australia) examined the impact of a clinical pharmacy programme [28]. The intervention was threefold; relationship building with stakeholders, nurse education, and medication review by clinical pharmacists. No significant differences in drug use (total drugs and subcategories) or morbidity indices (hospitalisation rates, adverse drug events) were identified.

Multi-disciplinary team meetings

Three studies (Table 2) evaluated the effect of MDT meetings on prescribing and two showed statistically significant findings [29, 30].

With a sample representing 5% of Swedish nursing homes, Schmidt et al. examined the impact of monthly MDT meetings on adherence to the 1994 Swedish Medical Product Agency (SMPA) prescribing guidelines [29]. The SMPA guidelines, which provide recommendations on the use of psychotropics, were available to all physicians in Sweden but were actively distributed to physicians in the intervention homes. The intervention resulted in a significant decrease in the prescribing of several psychoactive drugs. Crotty et al. (Australia) conducted MDT meetings in the presence of a representative from the Alzheimer’s Association of South Australia. The Medication Appropriateness Index (MAI) was used to assess the appropriateness of medication [30]. A within-facility control was also set up to assess any ‘carry-over’ effect. A significant improvement in appropriateness of prescribing and no evidence of ‘carry-over’ effect to other residents were demonstrated in the intervention homes.

King et al. (Australia) carried out a controlled before-and-after study where cases for discussion were selected by their GPs who then led a 30 min case discussion and management plan. No significant changes were reported in medication use, cost and mortality [17].

Computerised clinical decision support systems

Two studies (Table 2) evaluated the effects of CDSSs on prescribing in the elderly [31, 32]. One examined the effect of a CDSS on the appropriateness of drug orders in patients with renal insufficiency in Canada, and identified significantly more appropriate drug orders [31]. Gurwitz et al. (USA) identified no effects on the overall number of adverse drug events after implementation of a CDSS for 12 months [32].

Discussion

We identified 16 studies, grouped into one of four categories. Only one study used more than one intervention [28], although we categorised it as pharmacist review since this was the main component of the intervention. Multi-faceted interventions may be expected to be more powerful than using individual tools alone [33].

Staff education

Staff education, especially academic detailing, has the strongest evidence, with half of the studies having evaluated this intervention strategy and six of eight showing improvements in prescribing. The six ‘successful’ studies employed interactive techniques: academic detailing with face-to-face interaction between the prescribing physician and a group of experts, workshops for nurses, and family education. This review found that educating both physicians and nurses proved to be effective; previous work demonstrated that educating physicians alone was not as effective [34]. Two studies did not show any significant improvement in prescribing quality [24, 25]. Crotty et al. presented physicians with stroke management and psychotropic use guidelines together with audit results [24]. Audits’ limited effect is consistent with a Cochrane review which showed that audit and feedback have only a small to moderate impact on professional practice and healthcare outcomes [35]. Other limitations in the study, when compared with the more ‘successful’ studies, were fewer educational sessions and poor attendance by participating GPs. Rovner et al. had several flaws in their study design. The study had a small sample size and was conducted in a single 250-bed intermediate-level nursing home with risk of ‘cross-over’ effects between control and intervention groups [25].
<table>
<thead>
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<th>Follow-up</th>
<th>Statistically significant findings*</th>
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</thead>
<tbody>
<tr>
<td>Pharmacist medication reviews</td>
<td>Zermansky et al. (UK, 2006) [26]</td>
<td>RCT, 661 residents; 65 homes (13 nursing, 38 residential and 14 mixed)</td>
<td>Mean =85.1</td>
<td>Inclusion: residents on one or more repeat medicines Exclusion: in another trial, terminally ill, already on pharmacist-conducted medication review</td>
<td>Medication review of records by pharmacist Consultation with patient and carer Written recommendations to GP for approval and implementation</td>
<td>No. of changes in medication per participant, no. and cost of repeat medication, mortality, falls, hospital admissions, GP consultations</td>
<td>6 months</td>
<td>Increase in mean no. of drug changes per patient: 3.1 for intervention versus 2.4 for control ($P &lt; 0.0001$)</td>
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<td>Furniss et al. (UK, 2000) [27]</td>
<td>Cluster RCT, 330 NHR; 14 NHs</td>
<td>Mean =81.2</td>
<td>Each pair matched from different areas in South Manchester to avoid having homes looked after by the same GP</td>
<td>Regular review by pharmacist at GPs surgery, NH or over telephone Medical history, current medication details and problems identified by NH staff noted NHs revisited 3 weeks post-medicine review to ascertain whether there were any problems with medication changes or implementation</td>
<td>Type and no. of drugs, appropriateness of prescribing according to OGRA guidelines, use of primary and secondary care resources, no. of accidents and deaths</td>
<td>8 months</td>
<td>None</td>
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<td>Roberts et al. (Australia, 2001) [28]</td>
<td>Cluster RCT, 2261 NHR; 52 NHs (1 intervention : 3 control)</td>
<td>Mode= 80–89</td>
<td>Inclusion: at least 20 residents, within 3 h drive from study centre, supply of drugs under government medication subsidy scheme, and centralised hospitalisations, ADE and deaths records</td>
<td>Contact with GPs indirect Problem-based education sessions to nurses (6–9 sessions): basic geriatric pharmacology and common problems in long-term care e.g. depression Supported by wall charts, telephone consultations, clinical pharmacist visits: approximately 26 h contact per home Drug regimen review by clinical pharmacist for patients selected by NH staff</td>
<td>Mortality rate, no. of hospitalisations, ADE, drug use in terms of total number of drugs and their categories, prescription claims</td>
<td>1 year</td>
<td>None</td>
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<th>Statistically significant findings(^a)</th>
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</thead>
<tbody>
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<td>MDT meetings</td>
<td>Schmidt et al. (Sweden, 1998) [29]</td>
<td>Cluster RCT, 1854 NHR, 33 NHs</td>
<td>Mean =83.5</td>
<td>Inclusion: 2 homes chosen in each area in Sweden with similar NHR and staff characteristics, homes typical for that region, homes supervised by different physicians and separated geographically, physicians who are not geriatricians</td>
<td>Pharmacists arranged monthly MDT meetings, focused on communication skills, drug use in elderly, networking and problem solving and support. Attended by nurses, physicians, pharmacists, nursing assistants. Discussed drug use for individual patients.</td>
<td>Proportion of residents with any psychotropic drug, proportion of residents with 2 or more drug classes, proportion of residents with 2 or more drugs within the same class, proportion of residents with non-recommended and acceptable drugs in each psychotropic drug class using SMPA guidelines</td>
<td>12 months</td>
<td>Increase in 'acceptable' anxiolytics from 13.9% to 20.8% ((P=0.02)), decrease in antipsychotic prescribing by 19% ((P=0.007)), decrease in non-recommended hypnotics by 37% ((P=0.001)), increase in acceptable hypnotic use by 6% ((P&lt;0.001)), decrease in non-recommended antidepressants (TCAs) and increase in acceptable antidepressants (SSRIs)</td>
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<td>King, (Australia, 2001) [17]</td>
<td>Controlled before-and-after study, 245 NHR, 3 NH</td>
<td>Mean =79.8</td>
<td>GP selected NHR to review 31% of baseline residents reviewed</td>
<td>Weekly MDT meetings attended by GP, GP project officer, pharmacist, senior nursing staff, and other health care professionals. GP presented patient details, followed by a 30 min discussion and then formulated a management plan. Questionnaire to GP post-case conference to assess changes and usefulness of review.</td>
<td>No. of recommendations and whether beneficial to (i) NHR (ii) carers, changes in number of medications prescribed and administered, medication cost, mortality.</td>
<td>9 months</td>
<td>None</td>
<td></td>
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<tr>
<td>Study</td>
<td>Design</td>
<td>Participants</td>
<td>Mean Age</td>
<td>Inclusion</td>
<td>Intervention</td>
<td>Change in MAI</td>
<td>Change in NHBPSS</td>
<td>Change in Monthly Drug Costs</td>
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<td>Crotty et al. (Australia, 2004) [30]</td>
<td>Cluster RCT, 154 residents; 10 residential aged-care facilities</td>
<td>Mean = 84.5</td>
<td>Inclusion: patients prescribed &gt;5 medicines, those dependent for ADLs, those with challenging behaviour and about whom staff want more information and advice</td>
<td>2 MDT case conferences 6–12 weeks apart Attended by GP, geriatrician, pharmacist, residential care staff and representative from Alzheimer’s Association of South Australia Independent pharmacist reviewed medication chart pre- and post-intervention using MAI</td>
<td>Change in MAI, change in NHBPSS, changes in monthly drug costs</td>
<td>Change in MAI score improved in intervention: MAI mean change 4.1 (95% CI 2.1–6.1) versus control: MAI mean change 0.4 (95% CI −0.4 to 1.2, P = 0.001)</td>
<td>3 months</td>
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<td>Field et al. (Canada, 2009) [31]</td>
<td>Cluster RCT, 833 residents; one long-term care facility with randomisation of 22 long-stay units</td>
<td>Mean = 86.3</td>
<td>Inclusion: patients with renal insufficiency and all units with computerised physician order entry (CPOE)</td>
<td>62 alerts for maximum recommended daily dose/frequency of administration, medication to be avoided, and missing serum creatinine test results or weight</td>
<td>Proportion of alerts that led to an appropriate final drug order, overall rate of prescribing of ‘drugs that should be avoided’</td>
<td>Higher proportion of final drug orders that were appropriate in the intervention units: relative risk 1.2 (95% CI 1.0–1.4)</td>
<td>12 months</td>
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<td>Gurwitz et al. (USA and Canada, 2008) [32]</td>
<td>Cluster RCT, 1118 residents; 2 large long-term care facilities</td>
<td>Mean = 87.2</td>
<td>Inclusion: facilities with existing computerised physician order entry systems without CDSSs Exclusion: patients on short term care</td>
<td>Programmed to identify more than 600 potentially serious drug-drug interactions and to display alerts ADEs identified, determined if they were preventable, i.e. if they were errors due to drug-drug interactions etc. and then assessed whether any of the alerts included in the CDSSs could have prevented the prescribing of these drugs</td>
<td>Number of ADEs that could have been prevented by CDSSs, number of ADEs preventable by any means, and severity of the events</td>
<td>None</td>
<td>1 year in one facility and 6 months in the other</td>
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AD, academic detailing; ADE, adverse drug events; ADLs, activities of daily living; ADR, adverse drug reaction; AF, atrial fibrillation; CDSSs, computerised clinical decision support systems; CI, confidence interval; Cr, creatinine clearance; GP, general practitioner; HTN, hypertension; MAI, Mean Appropriateness Index; MDT, multi-disciplinary team; NHBPSS, Nursing Home Behaviour Problem Scale; NHR, nursing home residents; NHs, nursing homes; NSAIDs, non-steroidal anti-inflammatory drugs; OBRA, Omnibus Reconciliation Act; OT, occupational therapist; RCT, randomised controlled trials; SMPA, Swedish Medical Product Agency; SSRI, selective serotonin re-uptake inhibitors; TCA, tricyclic antidepressants.

*Only significant improvement in prescribing described.
M. Loganathan et al.

Computerised clinical decision support systems

There is considerable literature on the value of CDSSs. Evidence from US hospital settings suggests that drug safety can be improved by computerised physician order entry (CPOE) with CDSS [36]. One of the two studies that examined the effect of CDSS showed a positive effect, although the extent of the intervention might have been underestimated as study physicians cared for both control and intervention patients. The Gurwitz study [32] showed no significant difference in the rate of adverse drug events with CDSS; however, adverse drug events are rarer than inappropriate orders and as such differences are likely to be more difficult to detect. The CPOE system was also reported as not able to calculate total daily dose [32] and hence the high number of false alerts in the CPOE system may have led to ‘alert fatigue’, where the prescriber starts to ignore the alerts [37].

Multi-disciplinary team meetings

MDT meetings are commonly used to improve communication among healthcare professionals, and to optimise patient care. Of the three studies, those by Crotty et al. [30] and Schmidt et al. [29] found statistically significant changes in medication-related outcomes. Selection bias could have possibly been introduced in King et al.’s [17] study, where patients were selected for MDT discussion by their primary care physician. Staff involved in the MDT meetings also cared for control patients, possibly affecting their care. Moreover, with one month follow-up, this gives no indication of the long-term impact of the intervention.

Pharmacist medication reviews

The UK’s National Service Framework for Older People recommends that patients taking four or more drugs be reviewed six-monthly, with the remainder, annually [38]. The value of a pharmacist in conducting regular medication reviews to reduce IP in hospitals is well established [39–41] and similar results were anticipated in care homes. However, only one of three studies demonstrated a significant effect of pharmacists’ interventions on prescribing. This may partly be due to the inappropriate choice of outcome measures. Roberts et al. and Furniss et al., for example, used the change in the number of medications as a primary outcome measure. Although with increased number of medications, there is greater likelihood of adverse drug reactions, polypharmacy does not always reflect appropriateness of prescribing, as the initiation of some medications may be clinically indicated [42].

Choice of outcome measures

Outcome measures varied considerably with a number of authors interpreting a reduction in the total number of medication as an improvement in prescribing, which may not always be true. One of the UK-based studies used the US OBRA guidelines to assess appropriateness of prescribing. Others have used national or good practice guidelines. One used MAI but interestingly, none used Beers’s criteria [43], a USA-based tool commonly used to assess IP in nursing homes.

Limitations of review

Categorisation of articles was not always straightforward. For instance, academic detailing by pharmacists who reviewed case notes and identified points for discussion as part of an outreach programme was categorised as staff education and not pharmacist medication review [18, 22, 24]. Rovner’s study could potentially be classified as management by a specialist combined with MDT meetings [25], but was classified as an educational intervention. In addition, with a limited number of articles, some of which targeted psychosocial interventions more than pharmacotherapy (e.g. behavioural management more than improving prescribing), it is challenging to synthesise the evidence for improved prescribing in care homes [19, 21, 25].

The limited search terms and limit to the English language mean that this systematic review has its limitations. For instance, unless a quality improvement effort was indexed as an intervention, it would have been missed. The types of studies that we had aimed to retrieve have also been subjected to publication bias.

Some studies may be considered ‘old’, because prescribing guidelines and doctors’ training have evolved; however, we believe their strategies are still relevant.

Lastly, we acknowledge the difficulty in generalising findings from one country to another, due to differences in definitions, nature of personnel training and supervision of drug therapy.

Implications for policy and practice

For educational interventions to be effective, tailored programmes that employ several complementary techniques may be needed; academic detailing with educational reinforcement and follow-up should be directed at all healthcare professionals and possibly family members. Educational interventions can be easy and effective to implement as the knowledge gained is not patient-specific. Sustainability is supported if ‘in-house training’ is an option, as this will enable GPs to be regularly updated. Conversely, CPOE-CDSS is resource-intensive which may restrict its applicability in care homes.

Monthly pharmacist medication review is mandatory in the USA to improve prescribing in care homes; this has also been proposed for the UK [4]. In our review, MDT meetings [29, 30] as well as staff education [22, 24] involving pharmacists proved successful despite insufficient evidence for pharmacist-led reviews alone. Beneficial effects have been documented in hospitals and may be transferable to care homes, given sufficient pharmacist resource.
With those aged 65 and over predicted to account for 22% of the population by 2033, there needs to be clear guidelines for prescribing. The OBRA 1987 created a set of USA national minimum standards of care and rights for people living in certified nursing facilities [44]. We propose that UK policy be directed to improve the quality of prescribing in care homes based on results of controlled trials. Standardised measurements for measuring IP are also needed to enable effective benchmarking. Finally, we recommend that a combination of two or more interventional strategies is explored to improve prescribing in this population.

**Conclusion**

Improving prescribing in care homes is complex and there is limited evidence for effective interventions. This review demonstrated mixed results with substantial evidence and promising options for some of the interventions. Education including academic detailing seems to show most promise. Combinations of intervention strategies are likely to be required. Standardised measures for IP are needed to facilitate comparison across studies.

**Key points**
- There is limited evidence for most interventions but education including academic detailing seems to show most promise.
- Combinations of intervention strategies are likely to be required.
- Standardised measures for IP are needed to facilitate comparison across studies.

**Conflicts of interest**
Azeem Majeed is a GP Principal in a general practice that provides NHS services to residents of two care homes.

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**Supplementary data**
Supplementary data mentioned in the text is available to subscribers in *Age and Ageing* online.

**References**

The long list of references supporting this review has meant that only the most important are listed here and are represented by bold text throughout the paper. The full list of references is available at *Age and Ageing* online.


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